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Technological blending in the age of the Internet: A developing country perspective

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Abstract

The literature on ICT and development is almost totally disassociated from the earlier, more general work on technology and development. The former, moreover, is almost totally devoid of analytical categories that can bring some order to a vast, descriptive literature. The purpose of this paper, accordingly, is to use one concept from the technology and development literature to highlight and better understand some of the most promising innovations in developing countries. In particular, the paper shows that these examples well reflect the blending of ICT with the traditional technologies of radio and telephone.

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1. Introduction

It is remarkably difficult to find articles on ICT and development that situate themselves in the extensive body of literature that, beginning in the 1970s, addressed itself to topics such as technology transfer, technological capabilities, choice of technology and so on (that collectively are known ‘as technology and development’). Whatever the reasons for this near complete disjunction between the two bodies of literature, the problem, it seems, is that it impoverishes current attempts to harness ICT for the benefit of the majority of those living in developing countries. For, what then tends to characterize the ICT and development literature is a

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classification system based on *areas* of intervention (such as health, education and governance), rather than *approaches* or models that cut across the different policy areas. And the result, predictably, is that the large number of actual field experiences remain separated from the process according to which paradigms are created and changed over time.

The purpose of this paper is not to resolve so pervasive a problem as has just been described. The goal, rather, is to indicate how the use of just one concept from the literature on technology and development, can serve to bring some analytical order to bear on an otherwise unhelpful classification system (unhelpful, that is, from the point of view of those seeking an approach to using ICT for the benefit of rural areas in developing countries). The concept in question refers to the 'blending' of old and new technologies and it emerged in the 1980s as an alternative to the discredited approach of replacing, rather than retaining and using, the former technological vintages.¹

Following a brief review of the concept as it was enunciated at that time, the paper then seeks to show how the issues then being debated find their current expression in the efforts to combine ICT (especially the Internet) with more traditional modes of communication, rather than replacing the latter by the former (as occurs most typically in telecentres). More specifically, the paper argues that blending, in this as in other areas, is not an end in itself, but rather a way of ensuring that the benefits of new technology do not accrue only to a tiny minority of the rural population (as has recently occurred so strikingly in the case of telecentres in Africa).² Blending may contribute to an inclusive rather than an exclusive outcome for a number of reasons. One of them is that the widespread reach of the more traditional technology, reduces the costs of bringing the new technology to a wide audience. Or, what is not the same thing, technological blending may enhance the likelihood that the gains potentially available to the target group of beneficiaries are actually realized in practice. Yet another possibility is that those living in rural areas benefit from projects that only come into existence as a result of blending modern and traditional forms of technology.³

2. The concept of technological blending as formulated in the 1980s

Even among its original proponents in the International Labour Office, there is agreement that the idea of blending new and old technologies has not, thus far, been defined with any degree of precision. Much of the literature on this topic, moreover, was written (during the 1980s) before potential applications of the Internet to developing countries became a major concern to the international development community. Yet, there is agreement that the main thrust of the concept lies in its emphasis on the advantages of combining old and new information and communications technologies and the limitations it associates with attempts to leapfrog directly to the latter (as currently manifest most prominently in the Telecentre-based approach to the Internet in developing countries, which tends to eschew, rather than embrace, the opportunities afforded by older forms of technology). The problem with technological leapfrogging, as described in the

¹The two most important sources are ILO (1984) and Bhalla and James (1988).

²The evidence is fully set out in Etta and Wamahiu (eds.) (2003).

³Some of the material below draws on James (2004).

1980s was that the required preconditions simply do not exist in the majority of developing countries (and especially the least developed of those countries). For example:

Although the cost of many ‘high’ technologies is going down, it is still quite high relative to the national per capita incomes and foreign exchange availability in most developing countries. As long as the infrastructure and software requirements in these countries are not met, the ‘high’ technology hardware will remain too sophisticated to be used efficiently and at full capacity. (Bhalla & James, 1988, 34).

The same authors also draw specific attention to the crucial requirement that ‘existing technological capability is already at a level at which “high” technology can be assimilated and efficiently utilized’ (Bhalla & James, 1988, 34). Technological blending, on the other hand, embraces, rather than displaces, older forms of technology, and as such avoids the loss of skills, knowledge and traditional values, that occurs when older technologies are entirely supplanted. As then argued, moreover,

the introduction of new technologies that blend and interact fruitfully with traditional sectors has better prospects for local improvements, adaptations, experiments and innovation than do self-contained, turn-key technologies that allow narrow scope for local learning and for the development of indigenous capacity. And, although the introduction of new technologies inevitably involves readjustments in work habits and routines, life styles and other socio-economic institutions, technological progress is more likely to be tolerated and accepted through integration rather than disintegration. Finally, considering the severe resource constraints of Third World countries, blending offers an avenue for spreading the benefits of the new emerging technologies *in a more egalitarian and participatory fashion* than does the introduction of a necessarily limited number of enclave-like, capital-intensive, large-scale facilities. *The spread of frontier technologies to more users in the Third World is then a real and abiding component of the blending strategy.* (ILO, 1984, 24-5, emphasis added).

As noted above, the literature on blending largely predates the emergence of the Internet (and other new communications technologies) as a policy issue. One cannot help but be struck, however, by the degree to which the arguments cited in the previous quotation about blending in general, also lend support to the case for combining the Internet with relatively dated communications and other technologies, if the goal is ultimately to reduce rural poverty effectively. Let me then examine how this theoretical case applies to a set of actual blending projects and will be useful to classify these according to the most prevalent of the ‘traditional’ communications technologies, namely, radios and telephones. Note that the examples selected are not based on complex criteria. Rather, they are chosen because they are the most fully described, or even the only cases in a particular category. This implies that the examples will tend to be geographically as well as technologically diverse.

3. Blending the Internet with community radio

As noted by Girard (2003), there is a clear quantitative rationale for blending the Internet with radio, namely that the latter, which is widely owned in much of the Third World, can greatly

extend the reach of the former. In particular, 'A radio station with thousands of listeners that makes active use of the Internet can address the problem of access to the Internet's wealth of information with a tactic of *digital multiplication*, multiplying the impact of its Internet connection' (p. 11). This quantitative appeal of a blend between radio and the Internet, in itself says nothing about whether the information gleaned from the latter and conveyed to the listening public, will confer any of the benefits that are potentially available. Indeed, it is all too easy to conceive of circumstances in which the potential benefits go entirely unrealized. This would tend to occur, for example, if the knowledge in question fails to address local needs, or if it is presented in technical terms that are inaccessible to the target population. The general problem is that the Internet was designed in and for the needs of developed rather than developing countries and as such falls into the category of what used to be called inappropriate technology.⁴

Radio Kothmale in Sri Lanka is well known as an example of successful blending, in large part because it managed to avert the pitfalls associated with imported, Western technology. More specifically,

In Kothmale, radio browsing programmes [where presenters literally browse the Internet on air] focus on local economic activities, development and governance issues, culture and entertainment. The daily programmes respond to queries from listeners. Presenters first select relevant, reliable websites and broadcast the programme with local resource persons as studio guests (e.g. doctors for a health programme) who discuss the contents of the mostly English-language sites directly in the national languages. They also describe the websites and explain how they are browsing from one web page to another. Thus, listeners not only get the information they requested, but they understand how it is made available on the web. They can respond to the programme and they know that essential data will remain available in the community database if they wish to make individual use of it. With this daily radio programme, there is continuity within a common learning process encouraging greater inter-activity with and by the community.

The impact of this new way of creating shared meanings and interpretations of information for development is a key marker of the success of the project. The radio programme has triggered a greater interest among community members in receiving information related to poverty alleviation efforts, health, formal and non-formal education, livelihood skills and individual empowerment. (Hughes, 2003, 2).

What is perhaps most striking about the blending approach adopted at Kothmale is the stark contrast it presents with the Telecentre model of ICT and development, where only modern technologies are used. In particular, that model makes numerous computers with Internet connectivity available to a circumscribed number of persons who live within a reasonable distance from the Telecentre. Since most such persons appear to be uninterested in the new technology, as noted above, the ratio of costs to benefits cannot but be alarmingly high. In the Kothmale case, by contrast, quite the opposite seems to occur, since a single computer reaches thousands of listeners, who, for the most part seem to be aware of and interested in, the benefits that the Internet can confer on them (though, as yet, no rigorous evaluation of the case has been conducted).

⁴A term originally used by Stewart (1977).

It is hardly surprising then that technology blending as practiced in Kothmale, is being used in other parts of the developing world, where Internet exposure for the vast majority of inhabitants (especially those in rural areas) would otherwise be impossible. One such case is Radio Sagarmatha in Nepal, whose success has given rise to more than five other community radio stations in different parts of the country.⁵ Another interesting example is Radio Yungas, situated in rural Bolivia, where

The station has a daily program in which listeners send in their questions. The answers used to come from the 15 year-old encyclopaedia in the town library, but now they come from the Internet. When a local farmer sent in a description of an unknown worm that was eating his crops, Yungas sent the message out to a specialized electronic list. Six hours later they had an answer from a Swede, a leading worm expert, in which he identified the worm and explained how to deal with it. The answer was broadcast to the entire community and we can be sure that the farmer with the question was not the only one with the worm problem. (Girard, 2001, 8).

In Brazil, finally, a World Bank financed project to improve education on gender, is worth noting because of its explicit commitment to replace existing telecentres with their ‘obstacles of cost, language, local relevance of content and distance limit access for poorer residents—especially those in remote rural communities’ (World Bank, 2002).

What is perhaps more surprising, however, is that the blending of radio and the Internet has not spread *more* widely across developing countries. After all, not only are there compelling social and economic advantages associated with this particular blend, but also a number of successful models (or, more correctly, a number of apparently successful models awaiting formal evaluation), that could serve as a basis for replication elsewhere. In fact, a case could readily be made that combining the radio and the Internet is as promising a model for delivering the benefits of modern technology to rural areas, as has yet emerged from the original blending concept. When one adds to all this the spectacular failures of many prominent Telecentre ventures in Africa and elsewhere, it becomes all the more difficult to explain the comparative neglect of what is certainly one of the most exciting opportunities for ‘technological blending in the age of the Internet’.

Part of the answer, and perhaps a large part, lies in the nature of donor preferences for technology and the other part has to do instead with the negative attitudes of many developing country governments towards community radio. As regards the former, what needs to be recognized is that the literature on technology and development is replete with examples of how donors investing in developing countries tend to favour large-scale, capital- and foreign exchange-intensive projects. For, it is these projects that make it easier to meet ‘financial flow targets’, as compared with a large number of small ones (which may often) be far more socially desirable.⁶ With regard to the latter explanation, which turns on national rather than external factors, the

⁵Cited in Phipps (2004), who discusses the role of radio in the development of South Asia as a whole. Phipps also emphasizes that even in very poor communities, there is a very high degree of radio penetration.

⁶A point that was first eloquently argued by Tendler (1975). It forms an important part of the reason for the failure of African industry.

problem again takes a non-economic form. In particular, centralized bureaucratic regimes with a strong desire to retain political control is one important reason why,

very few developing countries have provisions in their broadcasting regulations to allow and encourage independent community radio stations. Empowerment is not merely a matter of providing physical access facilities. It includes removing barriers for communities to own and operate their own communication facilities. In this regard, liberalization of broadcasting to include community radio (apart from public and private) is essential. (Jayaweera, 2001)

One has only to reflect on the fact that the three largest countries in South Asia have relied exclusively on a centralized system of state broadcasting,⁷ to realize that blending of the kind thus far considered will need to be supplemented as far as possible by other technological combinations. Though it has by no means received the attention it deserves in this context, telephony represents an obvious alternative to radio and it is to this well-established mode of mass communication that the next section is devoted.

4. Telephony, blending and the Internet

Though well-known examples such as Kothmale Community Radio have brought this medium well into the realm of the debate on technological blending, the role of the telephone has been largely neglected. This may be due partly to an underestimation of *access* to the latter, a problem that arises when one takes only *ownership* statistics into account. For, in numerous developing countries the numbers of payphones have grown very rapidly, providing access to the typically high percentage of the population that does not enjoy ownership of a telephone.⁸ A few examples will serve to illustrate the point.

In South Africa, for example, it appears that, at the level of the country as a whole, the measure of access to telephones is more than twice as high as the figure for ownership. More specifically, data for the year 1997 indicate that whereas 42% of South Africans owned a telephone, some 80% had access to this form of communication (where access is defined as being within 30 min of a telephone).⁹ For the South Asia region, Minges and Simkhada (2002) have attempted to measure how many of the roughly 850 000 villages have a telephone and on the basis of this estimate, to gauge how many rural inhabitants in the region have access. What they find, after making a number of simplifying assumptions, is that 'some 800 million rural dwellers or 83% of the rural population—in South Asia have access to telephone service' (Minges & Simkhada, 2002, 6). Estimates such as these lend support to the first form of technological blending that we shall discuss in relation to the telephone and it arises in the context of rural extension services in developing countries (though, one should note that there are many other regions, such as sub-Saharan, where the extent of telephone access is far less favourable).

⁷For an extensive discussion of this point, see Page and Crawley (2001).

⁸In India, for example, Singhal and Rogers (2001) estimate that between 1988 and 1998, the number of villages with some kind of telephone facility grew from 27 316 to 300 000.

⁹Figures taken from CommUnity (1997).

5. Blending the telephone and the Internet for rural extension

Writing in the year 2000, Richardson bemoaned the fact that the scope for blending basic telephony with the Internet in rural areas had barely been realized, even with regard to basic extension services, which, as he correctly points out,

is an area where the telephone can be married with Internet tools very effectively ... For example, a handful of trained extension experts, backed by agricultural researchers and networks of input suppliers, marketing organizations and others ..., could provide prompt and accurate voice answers to questions they receive from farmers over the telephone. Initial agricultural knowledge and information needs assessments could determine key information needs and knowledge gaps that would generate frequently asked questions. Well-researched answers to probable frequently asked questions could be present in an on-line web-based database available to the extension experts, regardless of their physical location. As such a service develops, frequently asked questions can be tracked and additional researched answers added to the database. Very specific questions with answers not in the database would be referred to other extension experts or the agricultural research community for follow-up and reply to the information requestor. An one-list of experts, their specific fields of expertise, availability for fielding questions, email addresses, fax numbers and telephone numbers would be instantly available to information providers through the database. (Richardson, 2000, 19).

To what extent the potential for blending in this specific form, or even in other related forms, remains unrealized in 2004, is impossible to say without a search dedicated solely to this issue. What can be described, however, is an attempt by the Indian Ministry of Agriculture to bring some of the most complex information technology to bear on agricultural extension services, by making use of the widespread access to village telephones enjoyed in that country (as noted above). Officially inaugurated in January 2004, so-called 'Kisan Call Centres' provide information on the specific problems of individual farmers, in contrast to the existing top-down system of agricultural extension that has been heavily criticized over the years. In particular, farmers will be able to dial a common toll-free number with a query that is directed to the nearest call-centre and answered typically by a graduate agricultural student in the local language.¹⁰ If the question cannot be adequately answered, it is transferred through the computer system to a designated expert in an agricultural university or government research centre. That person will then provide his or her response directly to the caller.

Given the presence of a public payphone in the vast majority of Indian villages, this initiative clearly has the potential to redress the acute lack of information that has, and continues to beset all but a small minority of farmers in the country. And in so far as farmers comprise a relatively high percentage of those living in poverty, the call centres also seem potentially capable of having an economy-wide, as opposed to just a region or state-wide, impact on the problem (something it should be noted, that has rarely been achieved by ICT projects in developing countries). Such an effect is made more probable, moreover, by the fact that problems of illiteracy and language are taken into account, as they were in the Kothmale radio example described above. Much will

¹⁰A useful description of the Kisan call centres is to be found in The Times of India, March 1, 2004. See also <http://www.Kisancallcenter.org>.

depend, however, on the extent to which awareness of the facility is generated among the farming community and the degree to which unfamiliarity with the new, interactive mode of extension poses a problem among those who are aware of its existence.

6. The comparative neglect of combining voicemail with public payphones

In the previous example, of Kisan Call-Centres, such benefits as will hopefully accrue to farmers, flow from their ability to make outgoing telephone calls. In the much lauded case of Grameen village phones in Bangladesh, the benefits of being able to purchase outgoing calls from a village intermediary, appear to be considerable even amongst the poorer groups (Bayes, von Braun, & Akhter, 1999). In still another context, of telecentres in sub-Saharan, recent data attest to the popularity of the telephone in relation to other more complex information and communications technologies, such as e-mail and the Internet (Etta & Wamahiu, 2003).

What is common to these various examples is that they have all expanded the ability to make outgoing calls by means of telephones that are shared in one way or another. And the comparatively neglected problem to which this fact gives rise, is that without telephone ownership, *incoming* calls usually go unanswered. The loss to the individual is the information that such calls would have conveyed, whereas the symmetrical loss imposed on prospective callers is the inability to convey that information. In the case of a farmer or small enterprise, for example, the loss might comprise the product demand that would otherwise have been conveyed and to prospective callers the orders that could have been placed. To an unemployed person without ownership of a telephone, the same logic applies.

Looked at the other way round, the point is that there are gains to be had from supplying those who do not own a telephone with some form of voicemail, which records incoming calls that can subsequently be retrieved from a shared telephone. One might reasonably suppose that there are major gains to be reaped from the supply of voicemail boxes, since the segment of society without telephone ownership in most developing countries, heavily outweighs the minority of those who can afford to pay the various costs that ownership entails.¹¹ Yet, in spite of these seemingly large potential gains, few developing countries have sought to provide voicemail boxes to their citizens on a large scale.

One of the exceptional countries is Brazil, which ‘is using voice messaging technology to offer “virtual telephone service” to customers still without individual telephone service. Small businesses can rent a voice mail box for a monthly fee and check their messages from a payphone, providing a means for clients to contact them’ (Hudson, 1999). In the African context,

“Virtual phone” and calling card alternatives for those unable to afford their own phone are also an option being adopted by telecom operators in some countries such as Botswana and South Africa. Subscribers are issued their own unique phone number and pay a small rental for a voice mailbox, from which they can retrieve their messages from any telephone. A pager can also be tied to the system to immediately inform the subscriber that a message is waiting (Jensen, 2001, 10).

¹¹See telephone ownership per head data supplied by the International Telecommunications Union (ITU).

In each case the benefits will vary, in part, according to the availability of payphones to those without ownership of this mode of communication (since otherwise voicemail messages cannot be retrieved). Availability, in turn, depends not only on the total number of payphones per head, but also where they are located in relation to the geographical spread of the population. If, to take an extreme case, a relatively high proportion of the population lives in rural areas, even an above average number of payphones located predominantly in urban areas would yield few overall benefits. Or, put another way, despite the relative abundance of payphones, universal access in that hypothetical country would be far from universal. In South Africa, by contrast, telephone access is at least 80%, so that the vast majority of the population is able (within the constraint set by the definition of the term access) to retrieve its voicemail messages.

At the level of individual projects in developing countries, voicemail has been used to good effect in Peru by a privately owned American firm called Voxiva.¹² The goal of the project was to improve disease surveillance by combining (or blending) complex techniques of data analysis, with the existing infrastructure in the area (such as payphones in remote, mountainous locations).¹³ To this end, health professionals, such as rural doctors, were provided with instructions for entering digitized information about disease outbreaks on public payphones, for direct transmission to computers in the Department of Health. These particular individuals were also provided with voicemail, so that any information flowing outwards (about, say, the need for action following the outbreak of a disease) could be retrieved by using the same outlying payphones. This more effective use of payphones was one of the factors that helped to account for a drastic reduction in the time needed by health officials in Peru to learn about and respond to outbreaks of disease (from a matter of weeks, according to one estimate, to just days and hours.)

7. Telephone browsing of the Internet

In this last category of technological blending between ICTs and the telephone, the idea closely parallels the notion of radio browsing of the Internet described above. For, in this case, anyone with access to a telephone can browse the Internet regardless of whether he or she is illiterate, incapable of understanding English, or using a computer. In comparison with what was described above in connection with Kothmale community radio, however, telephone browsing is more heavily dependent on advances in technology and more specifically on technological change in interactive voice response (IVR) systems, which has produced an entirely new generation of these systems (the older generation was capable merely of responding to digits punched on the telephone with recorded prompts).¹⁴ The new generation of IVRs, by contrast, can be used as a way of interacting with users, for the collection and delivery of information, on the basis of speech recognition and text to speech engines. These newer IVRs, moreover, are being designed with the ability to run the same kind of query scripts through which the Internet runs via programming languages. Such features, in turn, enable the design of an IVR system that effectively operates as

¹²The Peruvian case study is described by Johnson and Rodriguez (2003).

¹³The decision to retain the existing infrastructure was an important cornerstone of the project as a whole. In effect, it was a decision to use an approach based on technological blending, as opposed to technological replacement.

¹⁴I owe the explanation that follows to Mr. Vinamra Agarwal of Prologix Software Solutions.

the telephonic equivalent of an Internet browser (hence the term telephone browsing). Quite literally, therefore, users can access information by speaking their requests into a telephone and receive the answers in speech form via the application of a text to speech engine. In India, an indigenous text to speech software programme has already been introduced. It permits the translation into speech of Indian text in 18 Indian languages.

Known as 'Vaachak', this software holds out the prospect of important applications designed specifically for the purpose of development. Not the least of these fall into the area of e-governance and include the ability to acquire information about land records and other text information over the telephone.¹⁵ To the extent that e-governance initiatives are expected to occur across India as a whole, they will need to rely heavily on this technology (and its ability to translate text into speech in 18 official languages), if these initiatives are to reach a wide segment of the illiterate, rural population (*Speech Technology Magazine*, November 19, 2002). Or, one could conceive of agriculture portals, which provide information on weather updates, agricultural news and local prices of commodities in centralized market places. As in the case of South Africa (described above), India has an exceptionally large supply of public payphones and these will help to facilitate the spread of development applications made possible by the particular blend of technologies known as browsing the Internet by telephone.

8. Conclusions

The literature on information technology and development is by now so voluminous that analytical categories are needed in order to view and interpret the available case evidence and guide policymaking in the area. Unfortunately, few, if any such categories have yet to be advanced, and the result is that the vast amount of descriptive material tends to remain isolated from the process according to which paradigms are created and altered over time. The purpose of this paper is to make a limited contribution towards redressing this unfortunate state of affairs, by highlighting one way in which hitherto fragmented material can be analytically consolidated into a distinct approach to policy. In particular, elements of the debate on technological blending from the 1980s are used to advance the case for combining more recent ICTs, especially the Internet, with the two most prevalent traditional modes of communication, namely, the radio and the telephone.

What emerges is that the retention, as opposed to the replacement of these traditional technologies, helps to increase the likelihood that the benefits of the new technologies are widely spread in developing countries (in contrast to the prevailing situation, where the replacement of traditional technologies by so-called telecentres, has clearly benefited only a tiny minority of the rural population). This more widespread distribution of benefits associated with technological blending, seemed to occur, for example, in the well-known 'radio-browsing' projects in Sri Lanka and Nepal, which involved the local community in an essential way. Most telling, perhaps, was the use of community experts in the translation and contextualization of information gleaned from the Internet during actual radio broadcasts (at Kothmale community radio in Sri Lanka). At any rate, the radio is now recognized as a promising way of introducing the Internet in a relatively

¹⁵Information about 'Vaachak' is to be found at www.prologix.com.

egalitarian form, to rural areas in developing countries. Most recently, a study by [Slater and Tacchi, 2004, 88](#)) has heavily emphasized the need to 'harness and circulate locally relevant knowledge and more specifically, the potential afforded by building on 'existing community media and multimedia models (particularly community radio and video) which have long traditions of community content development and participatory training and production. This can help shift computer and Internet use in the community from general purpose skills and information access to the production of locally relevant content, both through local management of information, and through incorporation of content into media and multimedia formats that are closer to the community'.

As regards the telephone, however, the scope for blending with new technologies has attracted far less attention. In part, this is probably due to the fact that some of the most promising applications are still at an early stage of the diffusion process. This is the case for example with the fascinating technological advances that allow for telephone browsing of the Internet and the call-centres (inaugurated in India in early 2004) that function effectively as Internet-enabled extension services for farmers in their own languages. Another reason for the comparative neglect of the telephone, is the tendency to take into account telephone ownership rather than telephone access. Yet, in numerous developing countries, the latter measure has recently grown very rapidly as a result of the installation of payphones across (rural) areas that have traditionally lacked this particular mode of communication. In India, for example, telephone access is now available to almost the entire population, because the vast majority of villages have been supplied with a public payphone.

What this implies, in turn, is that the payphone becomes the medium through which blending applications for the disadvantaged rural areas are likely to take place. As far as outgoing calls (from payphones) are concerned, it was suggested that the newly established call-centres in India, that function effectively as Internet enabled extension services, offer an intriguing and potentially vital example of technological blending. The problem with payphones, however, is that they usually do not allow for *incoming* calls. Since these calls may contain important information, there are likely to be substantial welfare gains from providing voicemail boxes to those who do not own a telephone, but do have access to a public payphone. Such gains were apparent in a health sector project in Peru, where doctors located in remote rural areas were provided with voicemail, allowing them to use payphones to respond promptly to instructions about disease outbreaks conveyed by officials from the Department of Health.

Finally, although national governments have played a constructive part in some of the examples, it remains true that much more could be done in the realm of promoting feasibility studies, R&D and so on, if the applications of technological blending are to spread more widely. And for their part, aid donors would do well to switch from transferring new technologies from the developed countries, to promoting successful blends of new ICTs with existing technologies.

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